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An emendation of *Fusticeps* and two new species from the Brazilian Amazon Forest

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Abstract — Two new species, *Fusticeps lampadiformis* and *F. papillatus*, are described and illustrated. The description of *Fusticeps* is emended to accommodate smooth-spored species, and a key to the four *Fusticeps* species is provided.

Key words—freshwater fungi, anamorphic fungi, taxonomy

Introduction

Webster & Davey (1980) established *Fusticeps* for the single species *F. bullatus,* collected on submerged leaves in Malaysia. The most conspicuous feature of the surface ornamentation of the conidia is a projection that expands to a thin-walled domed cap; according to Webster & Davey (1980), the air entrapped between the projections may possibly aid conidia flotation. This character was used to include this genus in the aero-aquatic hyphomycetes (Fisher 1977, Goh & Hyde 1996, Hyde & Goh 1998). The genus remained monotypic until Matsushima (1993) described F. laevisporus collected on dead leaves in Ecuador. The original generic description — "Mycelium septate, dark. Conidiophores erect, septate, unbranched or occasionally branched. Conidia holoblastic, integrated, solitary, dark, transversely septate, epispore fractured into irregular scales which entrap air" — does not accommodate *F. laevisporus,* which has smooth conidia; the rhexolytic conidial secession is not mentioned and only the broad basal scar is described. However, several characters shared by *F. bullatus* and *F. laevisporus* (e.g., conidial ontogeny, secession, morphology) justify emending the generic description of *Fusticeps* to accommodate species with smooth conidia.

There are few records of this genus in the literature. It has been collected in Malaysia and Ecuador in lentic environments (Webster & Davey 1980;

Matsushima 1993) and in Poland in lentic and lotic environments (Orlowska et al. 2004, Orlowska et al. 2006, Czeczuga et al. 2007).

During study of anamorphic fungi associated with submerged litter in the Brazilian Amazon forest, *Fusticeps* was very well represented by collections of the two previously described species and two new species, described here as *F. lampadiformis* (with ornamented conidia) and *F. papillatus* (with smooth conidia).

Materials& methods

Collecting expeditions were made in two different sites in Amazon forest, near Belém County, Pará State: Parque Estadual de Utinga and Área de Proteção Ambiental Ilha do Combu. Submerged litter was collected from streams and placed in plastic bags containing humid paper towels. In the laboratory, the samples were removed from the plastic bags and incubated in Petri dishes with moistened paper towels at ambient temperature (about 24°C). Samples were examined within two weeks after collection, and then periodically, using a dissecting microscope. For microscopic identification the specimens were placed on glass slides containing PVL resin (polyvinyl alcohol, lactic acid, and phenol). Measurements and digital images were made using an Olympus microscope BX51 equipped with bright field and Nomarski interference optics and a microscopy image acquisition DP25 digital color camera. Specimens in glass slides and dry material were deposited in the Herbarium of Universidade Estadual de Feira de Santana, Bahia, Brazil (HUEFS).

Taxonomy

Fusticeps J. Webster & R.A. Davey, Trans. Br. Mycol. Soc. 75: 341, 1980; emend. J.S. Monteiro & Gusmão

Colonies on natural substratum effuse, olivaceous to olivaceous brown, dark to very dark brown. Mycelium mostly immersed in the substratum, composed of septate, brown to pale brown hyphae. Conidiophores macro- or micronematous, erect, septate, unbranched or occasionally branched, pale brown. Conidiogenous cells holoblastic, integrated, determinate, terminal, cylindrical, pale brown. Conidial secession rhexolytic. Conidia solitary, clavate to pyriform, transversally septate, smooth or with conspicuous ornamentation, pale brown. Teleomorph unknown.

Type species: *Fusticeps bullatus* J. Webster & R.A. Davey

Fusticeps lampadiformis J.S. Monteiro & Gusmão, **sp. nov.** Plate 1a–j

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Differs from *Fusticeps bullatus* in producing pyriform to lampadiform, 2–3-septate conidia.

Type: Brazil. Pará: Parque Estadual do Utinga, 1°25′S 48°27′W, on unidentified submerged leaves, 18 Jan 2012, J. S. Monteiro (**holotype**, HUEFS 42783).

Etymology: *lampas* (Latin), referring to the conidial shape.

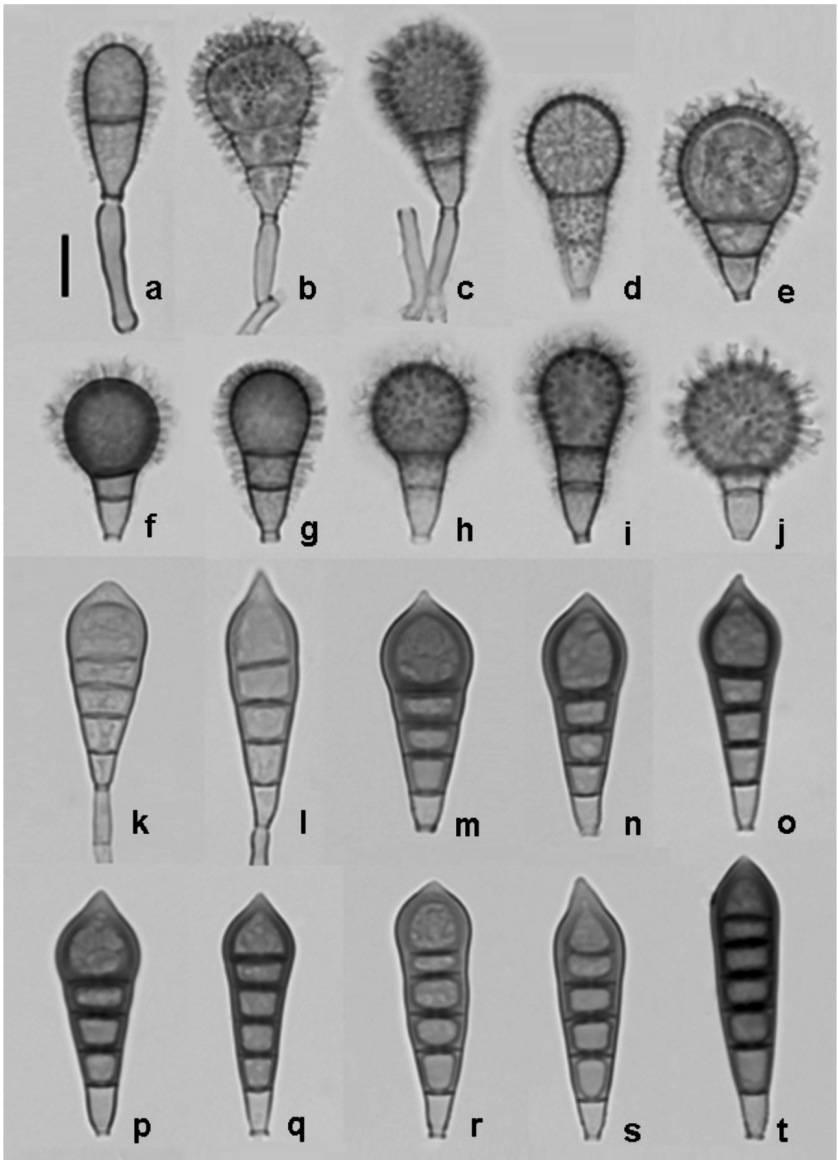

Plate 1.
Fusticeps lampadiformis: a. Immature conidia. b, c. Conidiogenous cell. d–j. Mature conidia.
Fusticeps papillatus: k, l. Conidiogenous cell. m–t. Mature conidia.
Scale bar = 10 μm.

Colonies on natural substratum effuse, olivaceous to olivaceous brown. Mycelium mostly immersed in the substratum, composed of septate, smooth, pale brown hyphae. Conidiophores micronematous, mononematous, unbranched or occasionally branched, straight, erect or slightly flexuous, septate, smooth, pale–brown, 22.5–62.5 × 2.5–5 µm. Conidiogenous cells monoblastic or rare polyblastic, integrate, determinate, terminal, cylindric, pale brown. Conidial secession rhexolytic. Conidia solitary, pyriform to lampadiform, 2–3 transversally septate, with cup-shape projections (3–5 × 1.5–2.5 µm) arising from the conidial wall, distal cell and intermediate cell brown, proximal cell pale brown, 21.5–35.5 × 12.5–18 µm; basal scar 2–3 µm.

Comments — *Fusticeps lampadiformis* is close to *F. bullatus*, which differs by conidia that are clavate, 3–4 septate, and have predominantly mushroom-shaped projections (Webster & Davey 1980).

Fusticeps papillatus J.S. Monteiro & Gusmão, **sp. nov.** Plate 1k–t

MycoBank MB 800032

Differs from *Fusticeps laevisporus* in producing clavate, 4–6 septate conidia with papillate apices.

Type: Brazil. Pará: Parque Estadual do Utinga, 1°25′S 48°27′W, on unidentified submerged leaves, 18 Jan 2012, J. S. Monteiro (**holotype**, HUEFS 42784).

Etymology: diminutive of *papula* (Latin), referring to the papilla at the conidial distal cell.

Colonies on the natural substratum effuse, dark brown. Mycelium mostly immersed in the substratum, composed of septate, smooth, brown to pale brown hyphae. Conidiophores micronematous, mononematous, unbranched or occasionally branched, grouped into 3–4, straight, erect or slightly flexuous, septate, smooth, pale–brown, 17.5–67.5 × 2.5–3.8 µm. Conidiogenous cells monoblastic, integrate, determinate, terminal, cylindric, brown to pale brown. Conidial secession rhexolytic. Conidia solitary, clavate, 4–6 transversally septate, smooth, distal cell thicker wall 1.5–2 µm, with a papilla (2–4 µm longer), distal cell and intermediate cells brown to pale brown, proximal cell pale brown, 35–45.5 × 11.5–15 µm; basal scar 2–3 µm.

Comments— *Fusticeps papillatus* is characterized by clavate, smooth, 4–6 septate conidia with a papilla at the apex of the distal cells. *Fusticeps laevisporus* is a comparable species but is distinguished by absence of a papilla and fewer conidial septa (Matsushima 1993).

Fusticeps bullatus J. Webster & R.A. Davey, Trans. Br. Mycol. Soc. 75: 342, 1980. Plate 2a–e

Colonies on the natural substratum effuse, dark. Mycelium mostly immersed in the substratum, composed of septate, smooth, pale brown hyphae.

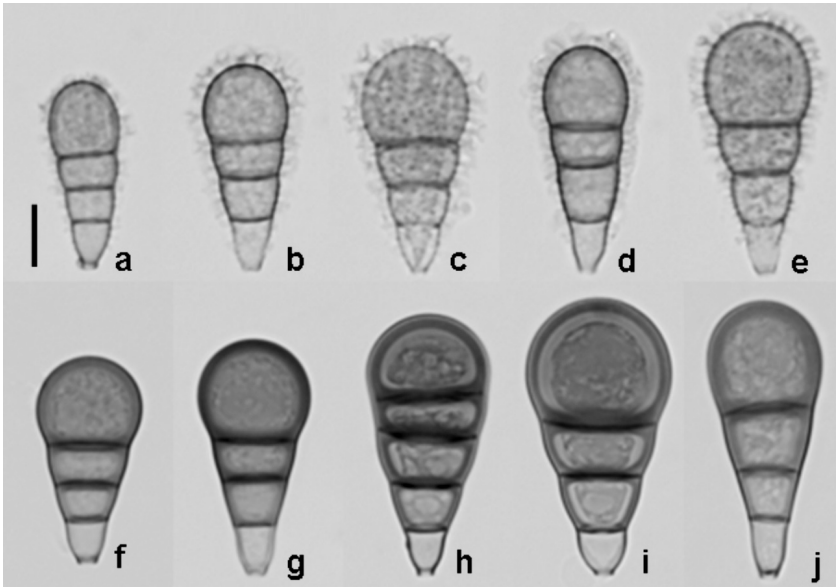

Plate 2. ***Fusticeps bullatus***: a–e. Mature conidia. ***Fusticeps laevisporus***: f–j. Mature conidia. Scale bar = 10 µm.

Conidiophores micronematous, mononematous, unbranched, septate, smooth, brown to pale brown 20–22.5 × 2.5–3.75 µm. Conidiogenous cells holoblastic, integrate, determinate, terminal, cylindric. Conidial secession rhexolytic. Conidia solitary, clavate, 2–3 transversally septate, with mushroom–shaped to cup–shaped projections (2.5 µm long) arising from the conidial wall, pale brown 23.5–34 × 10–13 µm; basal scar 2–3 µm.

Specimen examined: BRAZIL, Pará, Área de Proteção Ambiental Ilha do Combu, 1°29′S 48°25′W, on unidentified submerged leaves, 17 Jan 2012, J.S. Monteiro (HUEFS 42785).

Comments — *Fusticeps bullatus* is characterized by clavate, 3–4 septate conidia with mushroom-shaped to cup-shaped projections (Webster & Davey 1980). Our Brazilian specimens and Matsushima's (1993) Ecuadorian material, both from Amazon forest, have similar conidial dimensions and septation but differ slightly from the original Malaysian material (Table 1). Previously known from Malaysia, Ecuador, and Poland (Webster & Davey 1980, Matsushima 1993, Orlowska et al. 2004, Czeczuga et al. 2007); this is the first record for Brazil.

Fusticeps laevisporus Matsush., Matsush. Mycol. Mem. 7: 52, 1993. Plate 2f–j

Colonies on natural substratum effuse, dark. Mycelium mostly immersed in the substratum, composed of septate, smooth, pale brown hyphae.

Table 1. Synopsis of *Fusticeps* conidia

Species	Conidia			
	Size (µm)	Shape	Septa	References
F. bullatus	28–34 × 9–12	Clavate	3–4	Webster & Davey (1980)
	23.5–35 × 8–12.5	Clavate	2–3	Matsushima (1993)
	23.5–34 × 10–13	Clavate	2–3	This paper
F. laevisporus	30–44 × 9.5–13	Clavate	2–3	Matsushima (1993)
	25–40 × 10–20	Clavate	3–4	This paper
F. lampadiformis	21.5–35.5 × 12.5–18	Pyriform	2–3	This paper
F. papillatus	35.5–45.5 × 11.5–15	Clavate	4–6	This paper

Conidiophores micronematous, mononematous, unbranched, septate, smooth, brown to pale brown 20–47.5 × 2.5–3.75 µm. Conidiogenous cells monoblastic, integrate, determinate, terminal, cylindrical. Conidial secession rhexolytic. Conidia solitary, clavate, 3–4 transversally septate, smooth, distal cell with rounded apex and intermediate cells brown, proximal cell pale brown, 25–40 × 10–20 µm; basal scar 2–3 µm.

Specimen examined: BRAZIL, Pará, Parque Estadual do Utinga, 1°25′S 48°27′W, on unidentified submerged leaves, 18 Jan 2012, coll. J.S. Monteiro (HUEFS 42786).

Comments— *Fusticeps laevisporus* has smooth conidia and is comparable with *F. papillatus,* but differs by the rounded apex of the distal cell. Matsushima (1993) based his description of *F. laevisporus* on pure culture, and his conidia are narrower (9.5–13 µm) and have fewer septa (2–3) than our Brazilian material, but we consider the Ecuadorian and Brazilian collections to be conspecific. This species is a new record for Brazil; previously known from Ecuador and Poland (Matsushima 1993, Orlowska et al. 2006).

Key to *Fusticeps* species

Conidial measurements and morphologies are summarized in Table 1.

1. Conidia smooth 2
1a. Conidia with conspicuous ornamentation 3
2. Conidia 2–4-septate, apex rounded . . . . . *F. laevisporus*
2a. Conidia 4–6-septate, apex papillate . . . . . *F. papillatus*
3. Conidia pyriform, 2–3-septate . . . . . *F. lampadiformis*
3a. Conidia clavate, 3–4-septate . . . . . *F. bullatus*

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Literature cited

Czeczuga B, Muszynska E, Godlewska A, Mazalska B. 2007. Aquatic fungi and straminipilous organisms on decomposing fragments of wetland plants. Mycologia Balcanica 4: 31–44.

Fisher PJ. 1977. New methods of detecting and studying saprophytic behavior of aero-aquatic hyphomycetes from stagnant water. Trans. Br. Mycol. Soc. 68: 407–411. http://dx.doi.org/10.1016/S0007-1536(77)80194-0

Goh TK, Hyde KD. 1996. Biodiversity of freshwater fungi. J. Ind. Microbiol. Biotechnol. 17: 328–345. http://dx.doi.org/10.1007/BF01574764

Hyde KD, Goh TK. 1998. Acanthophysis–like structures from wood submerged in freshwater streams in the tropics. Mycoscience 39: 199–203. http://dx.doi.org/10.1007/BF02464060

Matsushima T. 1993. Matsushima Mycological Memoirs, vol. 7. Published by the author, Kobe.

Orlowska M, Lengiewicz I, Suszycka M. 2004. Hyphomycetes developing on water plants and bulrushes in fish ponds. Pol. J. Environ. Stud. 13: 703–707.

Orlowska M, Lengiewicz I, Ostrowska H. 2006. Conidial fungi on plants in the Biebrzański National Park. Acta Hydrochim. Hydrobiol. 34: 53–57.

Webster J, Davey RA. 1980. Two aero-aquatic hyphomycetes from Malaysia. Trans. Br. Mycol. Soc. 75: 341–345. http://dx.doi.org/10.1016/S0007-1536(80)80105-7